treatment time and simple radioprotection measures should position this new medical device as an interesting alternative for breast IORT.

OC-0480

External radiation therapy, extended surgery and intraoperative electrons for oligorrecurent pelvic cancer

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Purpose/Objective: To analyze prognostic factors associated with survival in patients after intensified radio-surgical rescue of oligorecurrent pelvic cancer, particularly the influence of external beam radiation therapy (EBRT).
Materials and Methods: From January 1995 to december 2011, 81 patients [colorectal (46%); gynecologic (26%); retroperitoneal sarcoma (18%)] underwent extended surgery [multiorgan (58%), bone (23%), vascular (9%), soft tissue (43%)] and intraoperative electron-beam radiation therapy [IOERT (10-15 Gy)] to the pelvic recurrence tumor bed. 35 (43%) of these patients also received EBRT (30.6-50.4 Gy). Survival outcomes were estimated using the Kaplan-Meier method, and risk factors were identified by univariate and multivariate analyses.
Results: Median follow-up was 34 months (3-189 months), and the 1-3-, and 5-year rates of locoregional control (LRC) were 83%, 53%, and 41%, respectively. Univariate Cox proportional hazard analysis revealed worse LRC for those patients who did not received integrated EBRT treatment for the pelvic recurrence rescue (p=0.003), and had non-radical resection (p=0.01). On multivariate analysis, integrated EBRT treatment, non-radical resection, and tumor fragmentation retained significance (p=0.002,p=0.004, and p=0.05, respectively).
Conclusions: EBRT treatment integrated for rescue, radical resection, and abscence of tumor fragmentation are associated with improved LRC in patients with oligorecurrent pelvic cancer. Present results suggest that patients with oligorecurrent pelvic disease ma ybenefit from EBRT treatment integrated with extended surgery and IOERT.

OC-0481

External-beam radiation therapy, surgery and intraoperative electrons for locally recurent rectal cancer

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Purpose/Objective: To analyze prognostic factors associated with survival in patients after intraoperative electrons containing resective surgical rescue of locally recurrent rectal cancer (LRRC), particularly the influence of an integrated component of external beam radiation therapy (EBRT).
Materials and Methods: From January 1995 to december 2011, 60 patients with pelvic recurrence from rectal inicial cancer primaries underwent extended surgery [n=38; multiorgan(43%), bone (28%), soft tissue (38%)] or non-extended (n=22) surgical resection, including a component of intraoperative electron-beam radiation therapy (IOERT) to the pelvic recurrence tumor bed. Twenty-eight (47%) of these patients were amenable and also received EBRT (range, 30.6-50.4 Gy). Survival outcomes were estimated using the Kaplan-Meier method, and risk factors were identified by univariate and multivariate analyses.
Results: Median follow-up was 36 months (range, 2-189), the 1- 3-, and 5-year rates of LRC were 86%, 52%, and 44%, respectively. On univariate analysis, patients with R1 resection (5-year LRC=55.7% vs. 19.0%, p=0.02) and not receiving EBRT (5-year LRC= 56.2% vs. 32.0%, p=0.02) were at a significantly higher risk of LR recurrence. Patients without tumor fragmentation, non-metastasic lymph nodes, abscence of perineural invasion and age > 55 had a lower risk of LRrelapse. We observed on multivariate analysis that margin status (R1resection), EBRT at the time of pelvic recurrence, no tumor fragmentation and non-lymph node metastasis retained significance with regard to LR relapse.
Conclusions: EBRT treatment integrated for rescue, resection radicality, and not involved fragmented resection specimens are associated with improved LRC in patients with locally recurrent rectal cancer. Additionaly tumor fragmentation could be compensated by EBRT. Present results suggest that a significant group of patients with oligorecurrent pelvic disease may benefit from EBRT treatment integrated with extended surgery and IOERT.

OC-0482

Intraoperative electron boost compensates adverse prognostic factors for pelvic recurrences in rectal cancer

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Purpose/Objective: Patients with locally advanced rectal cancer are reported to have a dismal prognosis, challenging expert interdisciplinary manaegment. The purpose of this study is to analyze the 15-years results of neoadjuvant-based multimodality treatment for locally advanced rectal cancer (LARC) with particular emphasis on intraoperative electron-beam radiotherapy (IEORT).
Materials and Methods: A total of 335 patients with LARC [≥cT3 93% and/or cN+ 69%) who underwent multimodality treatment between 1995 and 2011 were studied. The basic treatment principle was preoperative(chemo)radiotherapy, intended radical surgery, IOERT and elective adjuvant chemotherapy (aCT). In uni- and multivariate analyses, risk factors for all loco-regional recurrence (LR), IOERT in-field recurrence (IFR) and IOERT out-field recurrence (OFR) were studied.
Results: Median follow-up for all patients was 52. 2 months (range, 1-184), the 5 year overall survival, disease-free survival, local control, in-field and out-field control rates were 73.6%, 69.4%, 94.4%, 97.0% and 93.4%, respectively. Synchronic local and distant metastasic disease was present in 16% of the patients that recurred. In multivariate analysis distal margin distance < 20 mm [HR 3.74 (1.79-7.82),p < 0.001], ypN+ [HR 2.53 (1.16-5.54), p = 0.02] and tumor histology grade 3[HR 7.0 (2.8-17.56), p < 0.001]; Non-sphincter preserving surgery [HR 6.49(1.58-26.32), p=0.009], cT4 [HR 6.24 (1.34-29.1)], ypN+ [HR 7.41 (1.96-28.0)] and tumor histology grade 3 [HR 8.5 (2.8.-27.44), p < 0.001]; gender [HR 2.87 (1.10-7.46), p = 0.03], distal margin distance < 20 mm [HR 4.37 (1.68-11.34), p = 0.002] and no aCT [HR 2.62(1-03-1.68), p = 0.04] were associated with increased risk of LR, IFR and OFR, respectively.
Conclusions: Overall oncological results after multimodality treatment of LARC are promising. The positive impact of intraoperative radiotherapy on pelvic control does justify the inclusion of this therapeutic modality in prospective multi-institutional trials. Cancer death with uncontrolled pelvic progression was 28%. Adding aCT to the treatment may contribute to improve LR rates.

OC-0483

ISIORT-Europe Data Registry: main characteristics of IORT treatments

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Purpose/Objective: A joint analysis of data from centres within the ISIORT-Europe program was performed to investigate the role of intra-operative radiotherapy (IORT) and contribute to homogenize treatment modalities.
Materials and Methods: All ISIORT-Europe centres were invited to record the data of their IORT treatments using the appropriate file available at the website www.isiort.org/htm/isiort_europe.htm and send them to the data centre. All information (institution, patient data, tumour data, treatment modality) were therefore collected in a common database to analyse clinical and technical aspects of the treatments.
Results: Twenty one centers from Italy, Spain, Poland, Austria, Germany, France and Israel participated to this survey and data of 3,769 IORT cases from 1992 to 2012 were collected. Table 1 shows, as an example, some technical aspects of the treatment data.

Tumour site	Beam Energy (MeV)		Diameter of applicator (cm)		Dose (Gy)		Bevel Angle (°)	
BREAST (2999 cases, 69.8%)	6	25%	6	44%	10	49%	0	88%
	8	16%	5	32%	21	25%	15	6%
	10	11%	7	7%	20	9%	30	3%
	4	8%					0° – 45°	
Range:	4 – 18 MeV		2.5 – 10 cm		3 – 21 Gy			
	50 kV (target)	8%						
RECTUM (597 cases, 15.8%)	12	33%	6	33%	12.5	58%	45	63%
	15	30%	5	28%	10	27%	30	9%
	10	19%	7	26%	15	6%	22.5	4%
	6	5%	8	6%	12	3%		
Range:	6 – 15 MeV		2 – 15 cm		8 – 18 Gy		0° – 45°	
	50 kV (target)	2%						
SARCOMAS (221 cases, 6%)	6	33%	10	20%	10	44%	30	43%
	8	18%	12	18%	12.5	36%	15	26%
	12	10%	8	10%	12	8%	0	15%
	10	10%	5	10%	15	7%	45	12%
Range:	4 – 18 MeV		4 – 20 cm		10 – 25 Gy		0° – 45°	
	50 kV (target)	10%						
PROSTATE (114 cases, 3%)	9	43%	5.5	32%	12	73%	30	80%
	12	40%	5	28%	20	12%	22.5	15%
	7	7%	4	21%	18	7%	15	5%
Range:	6 – 12 MeV		3 – 7 cm		8 – 21 Gy		15° – 30°	
	50 kV (target)	2%						
PANCREAS (80 cases, 2%)	8	21%	8	31%	15	32%	30	37%
	9	16%	7	27%	12.5	23%	15	31%
	18	13%	6	13%	10	20%	0	19%
	6	13%	9	13%	18	10%	22.5	10%
Range:	4 – 18 MeV		5 – 10 cm		8 – 20 Gy		0° – 45°	

Conclusions: The availability of data from several centres active in IORT treatments may allow to perform data analysis useful to disseminate knowledge about clinical and technical aspects of this radiation modality and to dispose a basis for further clinical multicenter trials.

OC-0484
High count rate spectrometry for the characterization of miniature x-ray tubes
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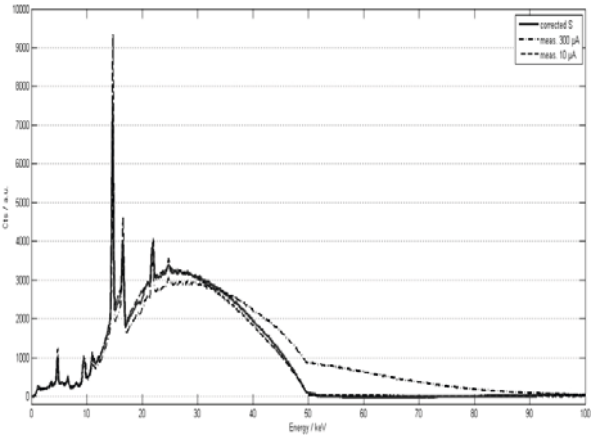
Purpose/Objective: Within the last years two types of miniaturized x-ray sources have become commercially available for radiation therapy treatment (RTT) and today about 300 devices are applied in clinics worldwide. The two types are manufactured by two different vendors: the 'Intrabeam®'-system from Carl Zeiss Meditec AG and the 'Axxent®' tube from Xoft (iCad, Inc.). Both devices emit an x-radiation field which energy distributionis given by a continuous Bremsstrahlung-spectrum with a maximum energy of 50keV and characteristic fluorescence lines induced by the material of the electron target and the materials in the pathway of the emitted photons. Despite this similarity the dosimetric and quality assurance procedures are different.
The German National Metrology Institute (PTB) is developing a primary standard in terms of absorbed dose to water for miniature x-ray sources which does not exist so far. In addition investigations will be done in order to find the best method for the dissemination of this quantity. As a basis of this work the spatial and energy distribution of the radiation fields must be studied. It was reported that the focal spot of the X-ray tube shifts with increasing beam current in case of the 'Axxent®' tube [1]. To answer the question if this effect arises a change of the spectrum spectrometry must be performed at different beam currents, also at the maximum beam current. Generally, spectra taken at high count rates show typical artefacts such as pulse pile-up distortions. In this work an algorithm is presented to consider these artefacts in the data evaluation.
Materials and Methods: Spectra were measured with an HPGe-Detecor (GLP 0110P, Canberra Industries) in combination with an analogue desktop spectrum analyzer (Eagle 5004) featuring pulse pile-up rejector circuits for high count rate spectrometry. The algorithm to eliminatethe remaining pulse-pile up artifacts was developed in MATLAB and is based on the approach that by using pile-up rejector circuits the remaining artifacts are given by a single or multiple convolution of the primary spectrum with itself.
Results: In Figure 1 three spectra of the 'Axxent®'tube taken at 50 kV tube voltages are presented. The spectrum measured at 300 µA beam current is given in a black dash-dotted line. The count rate during the measurement was more than 160000 Cts/s and the dead time of the spectrometry system was more than 65%. The spectrum shows significant pulse pile-up artefacts, clearly visible at photon energies above 50 keV. The spectrum reconstructed from the first one with the developed algorithm is given in full red line. For comparison, a spectrum measured at 10 µA beam current is shown in blue dashed line.



Conclusions: The spectrum reconstructed by means of the developed algorithm matches the spectrum taken at 10 µA. These findings assume to support the following conclusions: first the proposed algorithm works properly and second the spectra of the tube don't alter with varying beam currents.
[1] P. Sievers, et al. 41. DGMP Annual Meeting, Freiburg im Br. 29. 09. - 02.10.2010, Germany

OC-0485
Quality assurance procedures in intraoperative radioterapy (IORT) for locally advanced prostate cancer
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Purpose/Objective: Intra-operative radiotherapy (IORT) is an investigational approach for the treatment of locally advanced prostate cancer. The aim of this study is to analyze clinical, technical and organizational parameters to optimize the IORT procedure at our Institution.
Materials and Methods: In 2005, a program for IORT in high risk, locally advanced prostate cancer started at our Institution as anticipated boost for a dose of 12 Gy. The following clinical, technical and organizational parameters were defined for quality assurance (QA):
- multidisciplinary discussion by a dedicated staff,
- patients age < 76 years, probability of organ-confined disease < 25% according to MSKCC nomogram, KPS > 90,
- pre-surgical staging with bone scan and pelvic CT and/or MRI,
- specific informed consensus,
- complications assessment,
- measurement of prostate anterior-posterior (A-P) and transverse diameters on pre-surgical imaging and intra-operative ultrasound to define the electron beam energy,
- 'in vivo' rectal dose detection by 4 radio-chromic films positioned on a rectal probe,
- collimator diameter choose based on pre-operative imaging and on target identification directly in the surgical field,
- target including prostate plus a circumferential margin (0.5 cm),
- bevel angle (range 0°-30°) adapted on pubic arc anatomy and prostate exposure,
- multidisciplinary meeting for timing and technical details,
- evaluation of the procedure duration.

Results: Until July 2012, 84 patients were selected for IORT and 100% of them accepted the procedure. Median age was 68 years (range 52-76). Median iPSA was 14.6 ng/ml (range 2.0-63.9) and median GS was 8 (range 4-10); 64/84 met the selection criteria regarding the organ-confined disease. No major intra or post-operative complications occurred; 70% of patients required transfusion. We observed minor complications in 13/84 cases (15.5%) (lymphoceles, urethral-bladder anastomosis, strictures, pelvic haematomas). Median dose to the